

QIF PMI Report (QPR) User Guide

Version 2.0

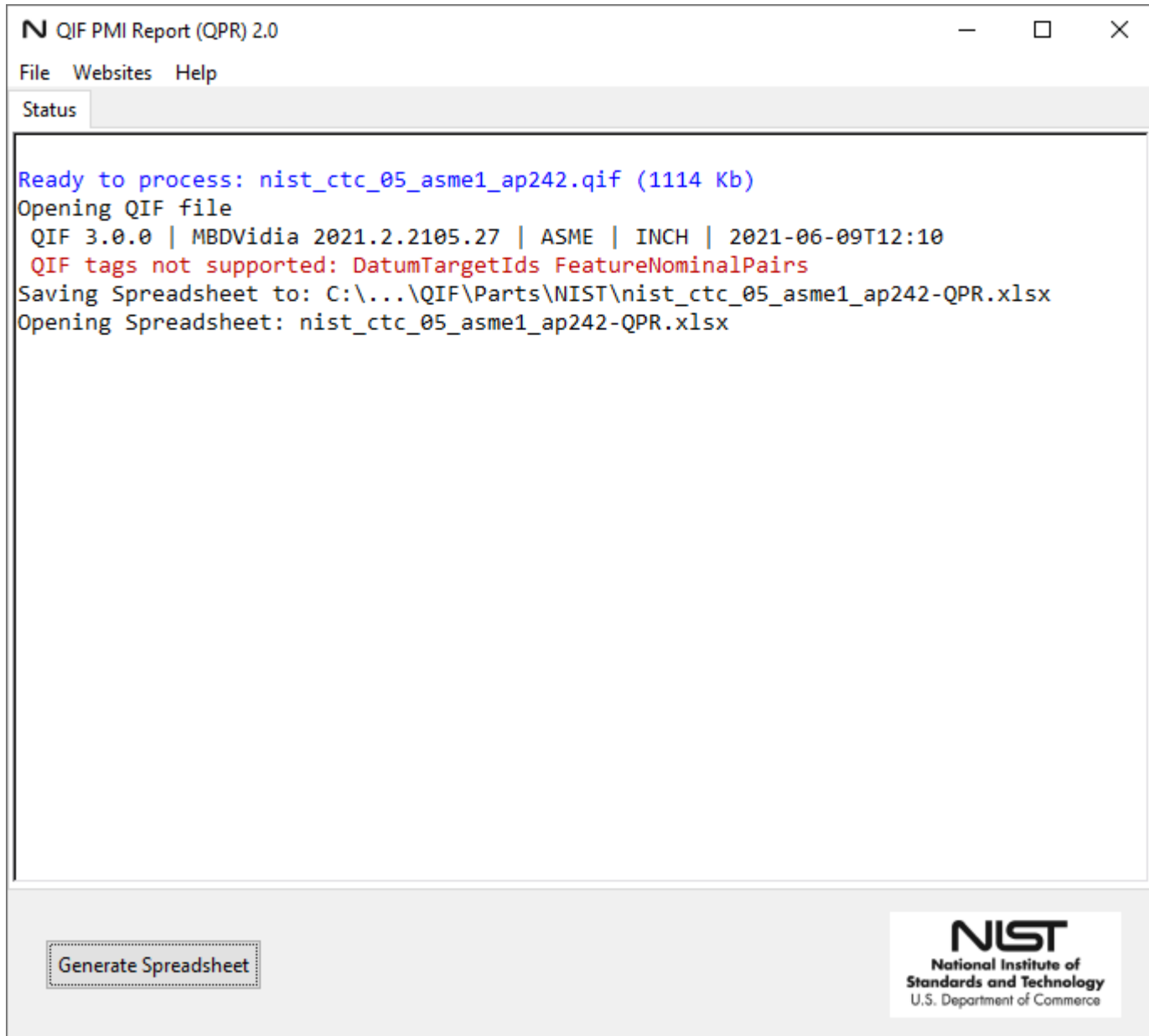
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<https://www.nist.gov/services-resources/software/qif-pmi-report-software>

QIF PMI Report

- QIF PMI Report (QPR) generates a spreadsheet from a QIF file and reports the Semantic PMI
 - PMI is the information that specifies dimensions, geometric tolerances, and datums defined by the QIF MBD
- A visual presentation of the PMI is created from the semantic definition
- Measurements and QPids are also reported
- QPR has been tested with QIF 2.0, 2.1, and 3.0 files
- QPR does NOT consider the Graphical PMI in a QIF file

Running QPR



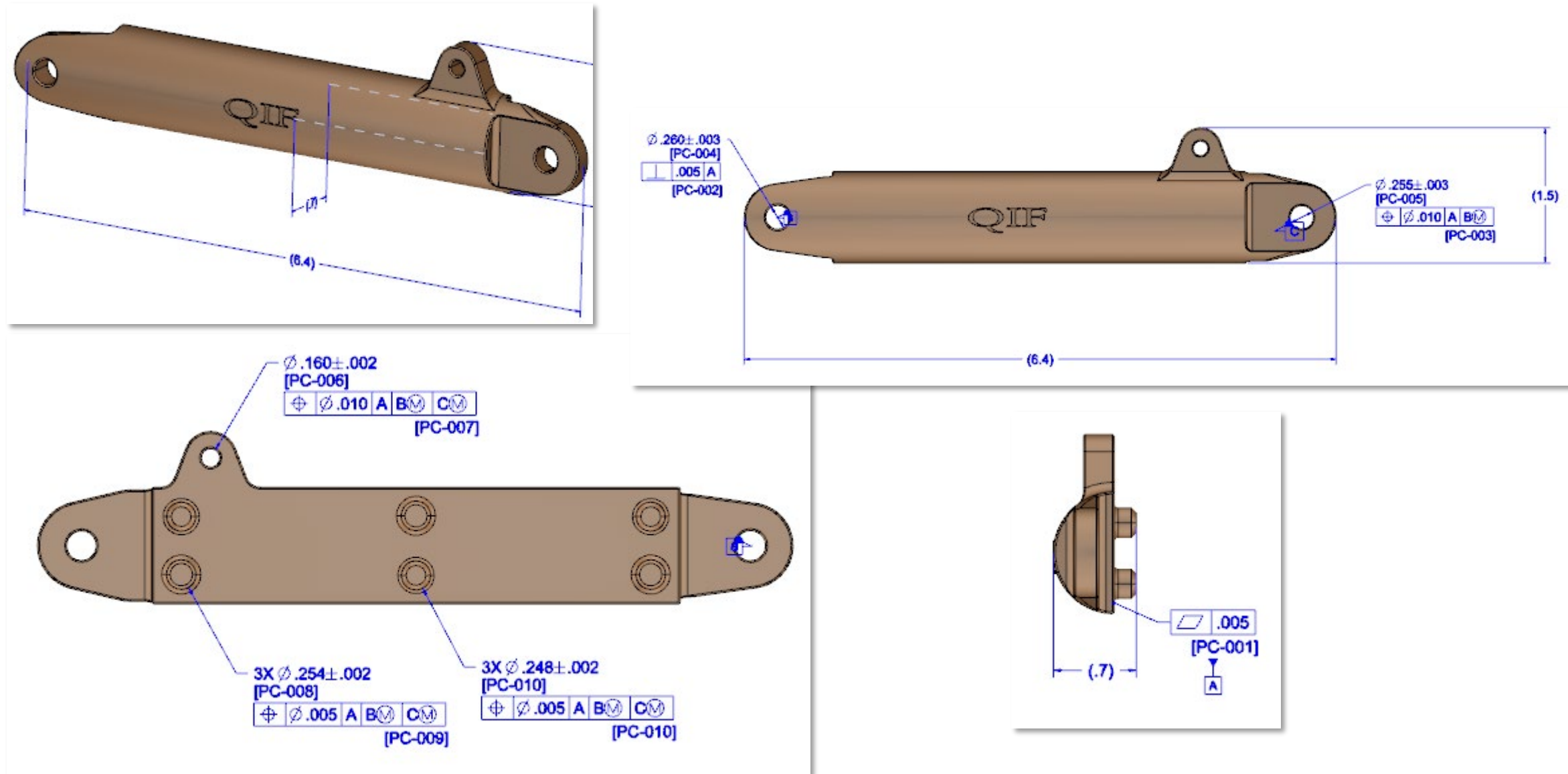
File menu – single or directories of QIF files can be selected

Status tab – output messages

Examples

- The following slides show specific examples of Semantic PMI in a worksheet generated from a QIF file
- The relationship between information the QIF file, Example Model, and worksheet is shown
- The Semantic PMI example is based on QIF 2.1

Example Model – DMSC QIF Strut



Example QPR Worksheet

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|--|------------------|---|--|
| Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X $\varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X $\varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 (1) Plane 5231 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | ∇ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| Perpendicularity (3337) | \perp $\varnothing.005$ A ∇ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3305) | $\varnothing.160 \pm .002$ \oplus $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Position (3312) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| Position (3325) | $\varnothing.255 \pm .003$ \oplus $\varnothing.010$ A B (M) ∇ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3332) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |

Rows

1 – File name, File date, QIF version

2 – Application that generated the QIF file, PMI Standards, Units

3 – Types of FeatureNominals found in the QIF file

Example QPR Worksheet

| | A | B | C | D | E |
|----|------------------------------|--|------------------|---|--|
| 1 | FileName, Date, Version | E:\Users\lipman\Documents\QIF\strut.qif 2017-04-20 20:32 QIF 2.1.0 | | | |
| 2 | App, Standard, Units | MBD\Idea, Pro/ENGINEER ASME-Y14.5-2009 INCH | | | |
| 3 | FeatureNominal Types | 10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line OppositeParallelPlanes Plane ToroidalSegment | | | |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | 0.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | 0.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | 0.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | 6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| 12 | DistanceBetween (5238, 5237) | 1.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 (1) Plane 5231 | 0-OVERALL 6B-RIGHT |
| 13 | Length (3689, 3688) | 1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
| 23 | Flatness (3243) | 0.005 ▽ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| 24 | Perpendicularity (3337) | 0.260 ± .003 ⊥ .005 A ▽ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 25 | Position (3305) | 0.160 ± .002 ⊕ Ø.010 A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 26 | Position (3312) | 0.255 ± .003 ⊕ Ø.005 A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 27 | Position (3325) | 0.255 ± .003 ⊕ Ø.010 A B (M) ▽ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 28 | Position (3332) | 0.255 ± .003 ⊕ Ø.005 A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |

Columns

A – Dimension, datum, datum reference frame, geometric tolerance and 'id' for each element. Second dimension 'id' is for dimension tolerance.

Example QPR Worksheet

| A | B | C | D | E |
|----|--------------------------------|---|------------------|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif 2017-04-20 20:32 QIF 2.1.0 | | |
| 2 | App, Standard, Units | MBD\Vidia, Pro/ENGINEER ASME-Y14.5-2009 INCH | | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line OppositeParallelPlanes Plane ToroidalSegment | | |
| 4 | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal |
| 6 | Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 |
| 7 | Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 |
| 8 | Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 |
| 9 | Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 |
| 10 | Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 |
| 11 | DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 |
| 12 | | | | (1) Plane 5231 |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 |
| 14 | | | | |
| 15 | Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | |
| 21 | DatumReferenceFrame (3335) | A | | |
| 22 | | | | |
| | Flatness (3243) | = .005 ▽ [A] | GDT_35 | Plane 4975 |
| 23 | | | | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| | Perpendicularity (3337) | Ø.260 ± .003 ⊥ .005 A ▽ [B] | GDT_37 | Cylinder 4963 |
| 24 | | | | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| | Position (3305) | Ø.160 ± .002 ⊕ Ø.010 A B (M) C (M) | GDT_40 | Cylinder 4977 |
| 25 | | | | 6C-BACK 7-CHARACTERISTICS |
| 26 | Position (3312) | ⊕ Ø.005 A B (M) C (M) | GDT_41 | Cylinder 4959 |
| | Position (3325) | Ø.255 ± .003 ⊕ Ø.010 A B (M) | GDT_38 | Cylinder 4967 |
| 27 | | | | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| | | ▽ [C] | | |
| 28 | Position (3332) | ⊕ Ø.005 A B (M) C (M) | GDT_42 | Cylinder 4961 |
| | | | | 6C-BACK 7-CHARACTERISTICS |

Columns

A – Dimension, datum, datum reference frame, geometric tolerance and ‘id’ for each element. Second dimension ‘id’ is for dimension tolerance.

B – Visual presentation of semantic PMI constructed from the element (column A) and association to other elements through a FeatureNominal

Example QPR Worksheet

| | A | B | C | D | E |
|----|------------------------------|--|-------------------------|-------------------------------|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents | QIF\strut.qif | 2017-04-20 20:32 | QIF 2.1.0 |
| 2 | App, Standard, Units | MBD\Vidia, Pro/ENGINEER | ASME-Y14.5-2009 | INCH | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone | ConicalSegment Cylinder | Plane CylindricalSegment Line | OppositeParallelPlanes Plane ToroidalSegment |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | 3X $\varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | 3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | 3X $\varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | 3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | 2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | 1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| 12 | | | | 1) Plane 5231 | |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
| | Flatness (3243) | ∇ .005 [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| 23 | | | | | |
| | Perpendicularity (3337) | \perp .005 A ∇ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 24 | | | | | |
| | Position (3305) | \oplus $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 25 | | | | | |
| | Position (3312) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 26 | | | | | |
| | Position (3325) | $\varnothing.255 \pm .003$ \oplus $\varnothing.010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 27 | | | | | |
| | | ∇ [C] | | | |
| 28 | Position (3332) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |

Columns

A – Dimension, datum, datum reference frame, geometric tolerance and ‘id’ for each element. Second dimension ‘id’ is for dimension tolerance.

B – Visual presentation of semantic PMI constructed from the element (column A) and association to other elements through a FeatureNominal

C – Element Name

Example QPR Worksheet

| | A | B | C | D | E |
|----|------------------------------|--|-------------------------|--|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif | 2017-04-20 20:32 | QIF 2.1.0 | |
| 2 | App, Standard, Units | MBDVideo, Pro/ENGINEER | ASME-Y14.5-2009 | INCH | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder | CylindricalSegment Line | OppositeParallelPlanes Plane ToroidalSegment | |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | 3X $\varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | 3X $\varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 6C-OVERALL 6A-FRONT |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 6C-OVERALL 6B-RIGHT |
| 12 | | | | (1) Plane 5231 | |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 6C-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
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| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
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| 23 | | | | | |
| | Perpendicularity (3337) | \perp .005 A ∇ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 24 | | | | | |
| | Position (3305) | \oplus $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 25 | | | | | |
| | Position (3312) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 26 | | | | | |
| | Position (3325) | $\varnothing.255 \pm .003$ \oplus $\varnothing.010$ A B (M) ∇ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 27 | | | | | |
| | Position (3332) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |
| 28 | | | | | |

Columns

A – Dimension, datum, datum reference frame, geometric tolerance and ‘id’ for each element. Second dimension ‘id’ is for dimension tolerance.

B – Visual presentation of semantic PMI constructed from the element (column A) and association to other elements through a FeatureNominal

C – Element Name

D – FeatureNominals types and ids, where sometimes there are multiple FeatureNominals per Element

Example QPR Worksheet

| | A | B | C | D | E |
|----|------------------------------|--|------------------|-----------------------------|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif | 2017-04-20 20:32 | QIF 2.1.0 | |
| 2 | App, Standard, Units | MBDVideo, Pro/ENGINEER | ASME-Y14.5-2009 | INCH | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line | | | OppositeParallelPlanes Plane ToroidalSegment |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | 3X $\varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | 3X $\varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| 12 | | | | (1) Plane 5231 | |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
| | Flatness (3243) | ∇ .005 [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| 23 | | | | | |
| | Perpendicularity (3337) | \perp .005 A ∇ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 24 | | | | | |
| | Position (3305) | \oplus $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 25 | | | | | |
| | Position (3312) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 26 | | | | | |
| | Position (3325) | $\varnothing.255 \pm .003$ \oplus $\varnothing.010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 27 | | | | | |
| | | ∇ [C] | | | |
| 28 | Position (3332) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |

Columns

A – Dimension, datum, datum reference frame, geometric tolerance and ‘id’ for each element. Second dimension ‘id’ is for dimension tolerance.

B – Visual presentation of semantic PMI constructed from the element (column A) and association to other elements through a FeatureNominal

C – Element Name

D – FeatureNominals types and ids, where sometimes there are multiple FeatureNominals per Element

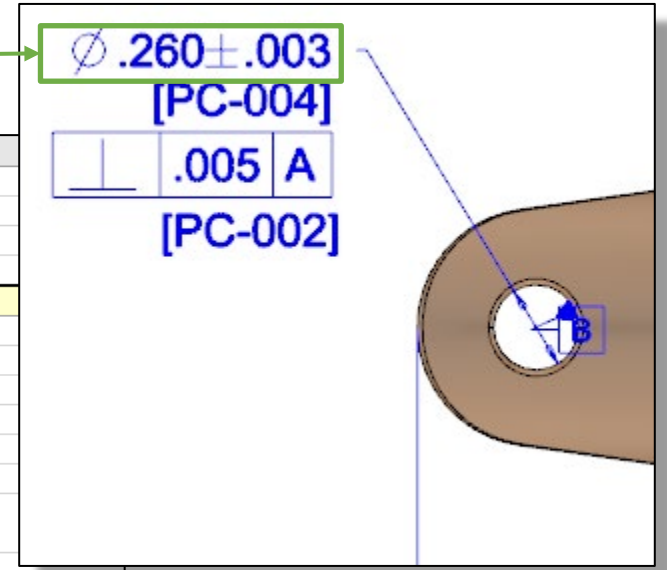
E – Saved Views

PMI Examples

- The following examples of semantic PMI show:
 1. A PMI example from the strut model and how it appears in the worksheet (column B)
 2. How IDs in the QIF file relate to each other
 3. How IDs in the resulting QPR worksheet (columns A and D) and relate to the QIF file
 4. The semantic information in the QIF file and how it is used to create the visual presentation (column B) of the Semantic PMI
 - Reminder: at no time is the Graphical PMI in the QIF file considered

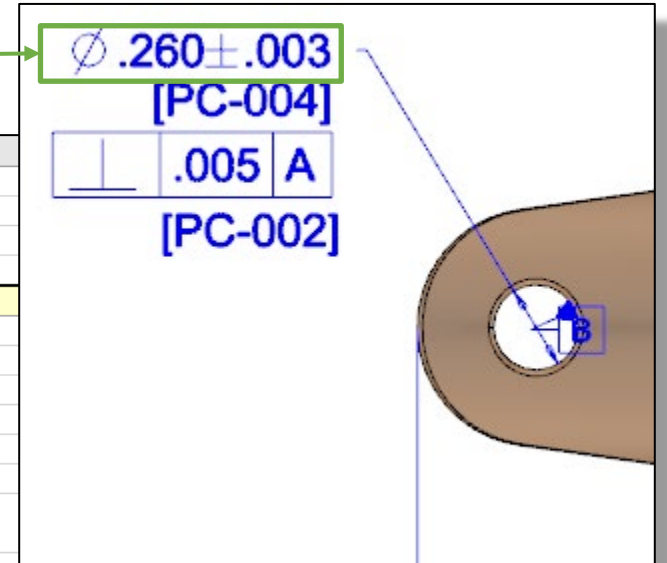
Diameter Dimension

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|---|------------------|-----------------------------|--|
| Diameter (3267, 3266) | $\varnothing .260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | $\varnothing .255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | $\varnothing .160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X $\varnothing .254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X $\varnothing .248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| | | | (1) Plane 5231 | |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | = .005 ▽ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| Perpendicularity (3337) | $\varnothing .260 \pm .003$ ⊥ .005 A ▽ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3305) | $\varnothing .160 \pm .002$ ⊕ $\varnothing .010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Position (3312) | $\varnothing .005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| Position (3325) | $\varnothing .255 \pm .003$ ⊕ $\varnothing .010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| | ▽ [C] | | | |
| Position (3332) | ⊕ $\varnothing .005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



Diameter Dimension

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|-----------------|------------------|-----------------------------|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-B |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-R |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-B |

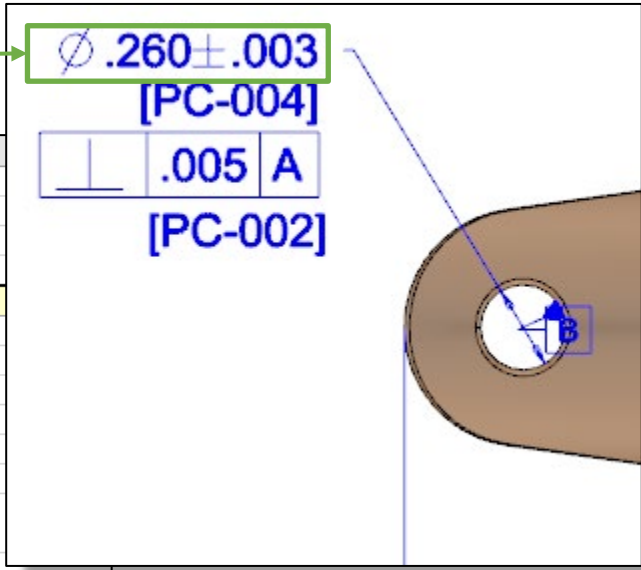


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    <Id>3262</Id>
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</CylinderFeatureNominal>
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Relating QIF CharacteristicNominal (diameter dimension) to CharacteristicDefinition (tolerance) and FeatureNominal (cylinder)



| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|-----------------|------------------|-----------------------------|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-B |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-R |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-B |

```

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    <Id>4963</Id>
  </FeatureNominalIds>
  <Name>AE_DRIVEN_DIM0</Name>
  <KeyCharacteristic>
    <Designator>9</Designator>
  </KeyCharacteristic>
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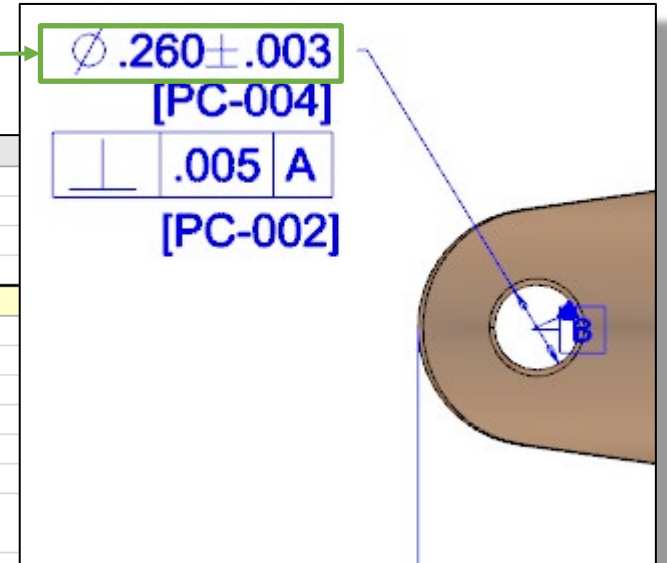
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  <FeatureDefinitionId>4962</FeatureDefinitionId>
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    <AxisPoint>0 0 0.09</AxisPoint>
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```

Relating QIF 'ids' to worksheet

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|-----------------|------------------|-----------------------------|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3268) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (4) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-B | |
| Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-R | |
| Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-B | |



```

<DiameterCharacteristicNominal id="3267">
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  <FeatureNominalIds n="1">
    <Id>4963</Id>
  </FeatureNominalIds>
  <Name>AE_DRIVEN_DIM0</Name>
  <KeyCharacteristic>
    <Designator>9</Designator>
  </KeyCharacteristic>
  <TargetValue decimalPlaces="2">0.26</TargetValue>
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</CylinderFeatureNominal>
    
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Constructing PMI from semantic values

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|-----------------|------------------|-----------------------------|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3268) | Ø.265 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (4) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-B | |
| Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-R | |
| Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-B | |


```

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  </KeyCharacteristic>
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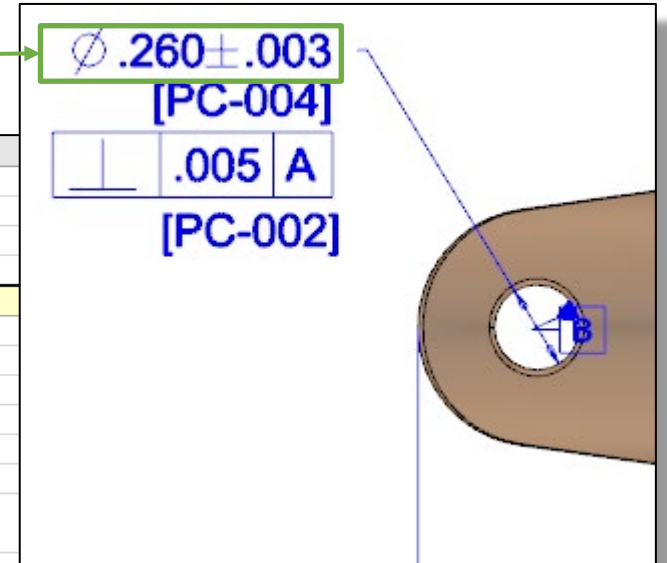
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Associating Saved Views to PMI

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|--------------------------------|------------------|--|-------------------------------------|
| Diameter (3267, 3266) | $\varnothing .260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | $\varnothing .255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | $\varnothing .160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X $\varnothing .254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X $\varnothing .248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK | |
| Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS | |
| Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK | |



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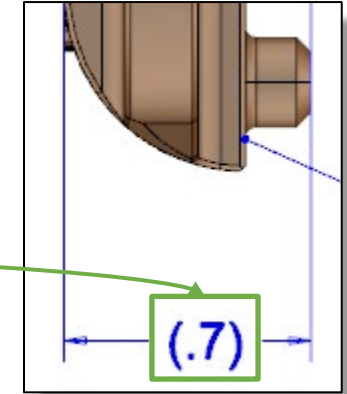
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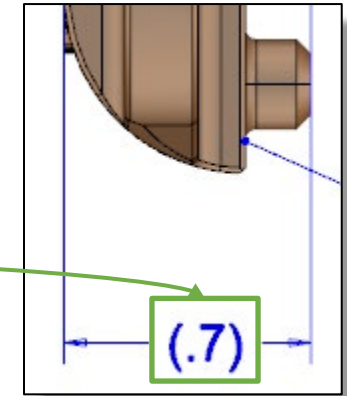
Distance Between

| | A | B | C | D | E |
|----|------------------------------|---|------------------|-----------------------------|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif 2017-04-20 20:32 QIF 2.1.0 | | | |
| 2 | App, Standard, Units | MBDVideo, Pro/ENGINEER ASME-Y14.5-2009 INCH | | | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line OppositeParallelPlanes Plane ToroidalSegment | | | |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | $3X \varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | $3X \varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | (.64) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| 12 | | | | (1) Plane 5231 | |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
| | Flatness (3243) | = .005 ▽ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| 23 | | | | | |
| | Perpendicularity (3337) | $\varnothing.260 \pm .003$ ⊥ .005 A ▽ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 24 | | | | | |
| | Position (3305) | $\varnothing.160 \pm .002$ ⊕ $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 25 | | | | | |
| | Position (3312) | $\varnothing.255 \pm .003$ ⊕ $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 26 | | | | | |
| | Position (3325) | $\varnothing.255 \pm .003$ ⊕ $\varnothing.010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 27 | | | | | |
| | | ▽ [C] | | | |
| 28 | Position (3332) | ⊕ $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



Distance Between

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|-----------------|------------------|--|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (.64) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 (1) Plane 5231 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK | |
| Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS | |
| Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK | |



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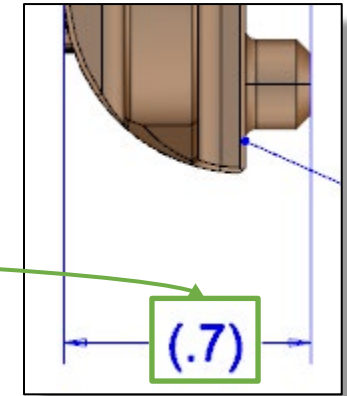
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Distance Between

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|------------------------------|-----------------|------------------|--|-------------------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (.64) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 (1) Plane 5231 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK | |
| Datum (3254) | A | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS | |
| Datum (3263) | B | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK | |



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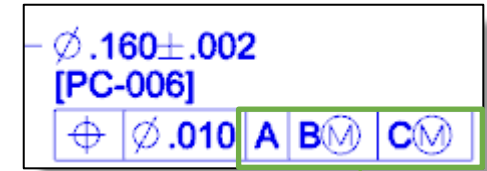
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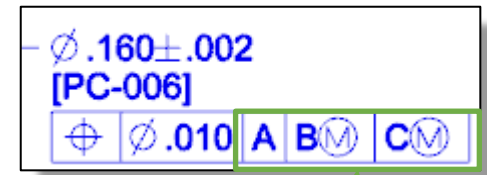
Datum Reference Frame

| | A | B | C | D | E |
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| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif 2017-04-20 20:32 QIF 2.1.0 | | | |
| 2 | App, Standard, Units | MBD\Vidia, Pro/ENGINEER ASME-Y14.5-2009 INCH | | | |
| 3 | FeatureNominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line OppositeParallelPlanes Plane ToroidalSegment | | | |
| 4 | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Saved View |
| 6 | Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 7 | Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 8 | Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 9 | Diameter (3276, 3275) | $3X \varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| 10 | Diameter (3279, 3278) | $3X \varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| 11 | DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| | DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| 12 | | | | (1) Plane 5231 | |
| 13 | Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| 14 | | | | | |
| 15 | Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| 16 | Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| 17 | Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| 18 | | | | | |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | | |
| 21 | DatumReferenceFrame (3335) | A | | | |
| 22 | | | | | |
| | Flatness (3243) | ∇ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| 23 | | | | | |
| | Perpendicularity (3337) | \perp $\varnothing.260 \pm .003$ [A] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 24 | | | | | |
| | Position (3305) | $\varnothing.160 \pm .002$ \oplus $\varnothing.010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| 25 | | | | | |
| | Position (3312) | $\varnothing.255 \pm .003$ \oplus $\varnothing.005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| 26 | | | | | |
| | Position (3325) | $\varnothing.255 \pm .003$ \oplus $\varnothing.010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| 27 | | | | | |
| | | ∇ [C] | | | |
| 28 | Position (3332) | \oplus $\varnothing.005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



Datum Reference Frame

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|--|------------------|-----------------------------|-----------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | = .005 | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACT |
| Perpendicularity (3337) | | | | 7-CHARACT |
| Position (3305) | | | | RISTICS |
| Position (3312) | | | | RISTICS |
| Position (3325) | Ø.255 ± .003 ⊕ Ø.010 A B (M) ▽ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Position (3332) | ⊕ Ø.005 A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



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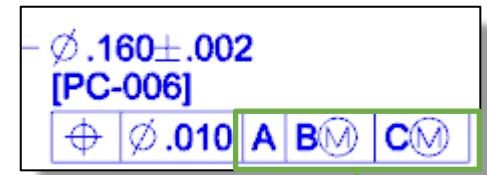
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Datum Reference Frame

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|------------------------------|--|------------------|-----------------------------|-----------------------------|
| Diameter (3267, 3266) | Ø.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3270, 3269) | Ø.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3273, 3272) | Ø.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X Ø.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X Ø.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | Plane 4975 | | 5-DATUMS 6A-FRONT 6B-RIGHT |
| Datum (3263) | B | Cylinder 4963 | | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | = .005 | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACT |
| Perpendicularity (3337) | | | | 7-CHARACT |
| Position (3305) | | | | 7-CHARACT |
| Position (3312) | | | | 7-CHARACT |
| Position (3325) | Ø.255 ± .003 ⊕ Ø.010 A B (M) ▽ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Position (3332) | ⊕ Ø.005 A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



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Datum Reference Frame

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| Diameter (3267, 3266) | 0.260 ± .003 | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3270, 3269) | 0.255 ± .003 | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Diameter (3273, 3272) | 0.160 ± .002 | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X 0.254 ± .002 | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X 0.248 ± .002 | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | Cylinder 4967 | | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | Plane 4975 | | 5-DATUMS 6A-FRONT 6B-RIGHT |
| Datum (3263) | B | Cylinder 4963 | | 5-DATUMS 6A-FRONT 6C-BACK |
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| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | = .005 | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARAC |
| Perpendicularity (3337) | | | | 7-CHARAC |
| Position (3305) | | | | 7-CHARAC |
| Position (3312) | | | | 7-CHARAC |
| Position (3325) | 0.255 ± .003 ⊕ 0.010 A B (M) ▽ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARAC |
| Position (3332) | ⊕ 0.005 A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |


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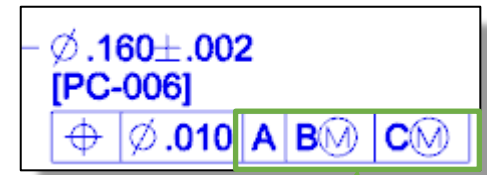
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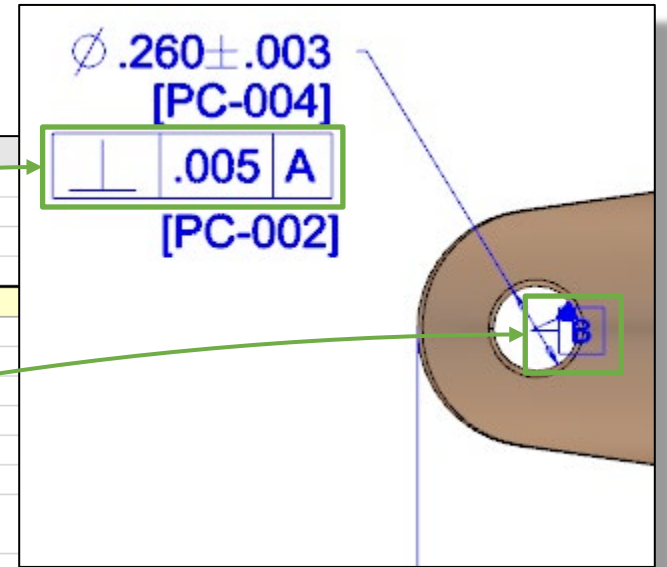
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DatumDefinition for A (3254), B (3263) are not shown



Perpendicularity Tolerance

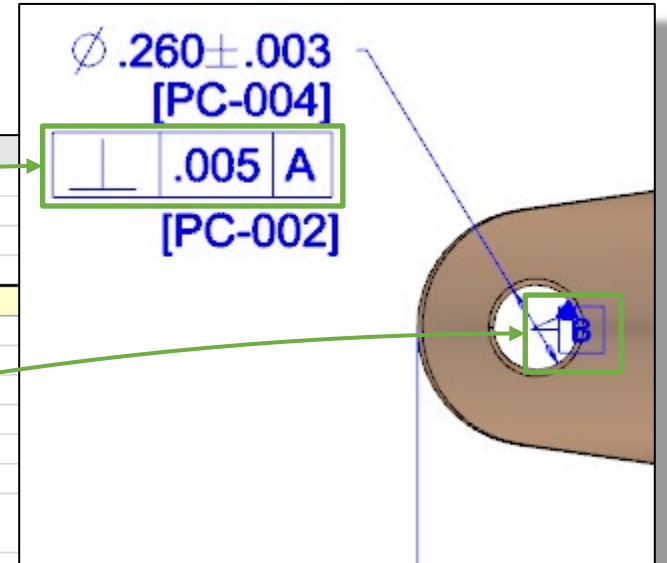
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|------------------------------|--|------------------|-----------------------------|--|
| Diameter (3267, 3266) | $\varnothing.260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | $\varnothing.255 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | $\varnothing.160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X $\varnothing.254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X $\varnothing.248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| | | | (1) Plane 5231 | |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | CylindricalSegment 5218 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | $\nabla .005$ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| Perpendicularity (3337) | $\perp .005 A$ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3305) | $\varnothing.160 \pm .002$ $\oplus \varnothing.010 A B (M) C (M)$ | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Position (3312) | $\oplus \varnothing.005 A B (M) C (M)$ | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| Position (3325) | $\varnothing.255 \pm .003$ $\oplus \varnothing.010 A B (M)$ ∇ [C] | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3332) | $\oplus \varnothing.005 A B (M) C (M)$ | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



The Graphical PMI above does not look the same as the PMI in cell B24. Datum feature B is not attached to the feature control frame above. However, semantically the PMI above and to the left are identical because they are both associated with the same Cylinder.

Perpendicularity Tolerance

| File Name, Date, Version | C:\Users\lipman\Documents\QIF\strut.qif | 2017-04-20 20:32 | QIF 2.1.0 | |
|----------------------------|---|------------------|-----------------|--------------------------------|
| App, Standard, Units | MBDVideo, Pro/ENGINEER ASME-Y14.5-2009 INCH | | | |
| Feature Nominal Types | (10) Circle CircularArc Cone ConicalSegment Cylinder CylindricalSegment Line OppositeParallelPlanes Plane ToroidalSegment | | | |
| Element (id) | PMI | Name | Feature Nominal | Saved View |
| Diameter (3267) | 0.260 ± .003 | AE DRIVEN DIME | Cylinder 4963 | 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3268) | 0.260 ± .003 | AE DRIVEN DIME | Cylinder 4963 | 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3269) | 0.260 ± .003 | AE DRIVEN DIME | Cylinder 4963 | 7-CHARACTERISTICS |
| Diameter (3270) | 0.260 ± .003 | AE DRIVEN DIME | Cylinder 4963 | 7-CHARACTERISTICS |
| Distance (3271) | | | | ALL 6A-FRONT |
| Distance (3272) | | | | ALL 6B-RIGHT |
| Length (3273) | | | | ALL 6A-FRONT |
| Datum (3254) | A | Plane 4975 | | 5-DATUMS |
| Datum (3263) | B | Cylinder 4963 | | 5-DATUMS |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | 0.005 | GDT_35 | Plane 4975 | 5-DATUMS |
| Perpendicularity (3337) | 0.260 ± .003 ⊥ .005 A [B] | GDT_37 | Cylinder 4963 | 5-DATUMS |
| Position (3305) | 0.160 ± .002 | G | | CK 7-CHARACTERISTICS |
| Position (3312) | ⊕ 0.010 A B (M) C (M) | G | | CK 7-CHARACTERISTICS |
| Position (3325) | ⊕ 0.005 A B (M) C (M) | G | | UMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3332) | ⊕ 0.010 A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



```

<PerpendicularityCharacteristicDefinition id="3337">
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  </ZoneShape>
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    <AttributeStr name="CAMC" value="No"/>
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  </KeyCharacteristic>
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<DatumDefinition id="3263">
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  <FeatureNominalIds n="1">
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```

Perpendicularity Tolerance

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|--------------|--|-------------------------------|----------------|---|
| 6 | <PerpendicularityCharacteristicDefinition id="3337"> | | | 6A-FRONT 7-CHARACTERISTICS |
| 7 | <StatisticalCharacteristic>false</StatisticalCharacteristic> | | | 6A-FRONT 7-CHARACTERISTICS |
| 8 | <ToleranceValue>0.005</ToleranceValue> | | | 7-CHARACTERISTICS |
| 9 | <DatumReferenceFrameId>3335</DatumReferenceFrameId> | | | 7-CHARACTERISTICS |
| 10 | <MaterialCondition>NONE</MaterialCondition> | | | 7-CHARACTERISTICS |
| 11 | <ZoneShape> | | | ALL 6A-FRONT |
| 12 | <PlanarZone/> | | | ALL 6B-RIGHT |
| 13 | </ZoneShape> | | | ALL 6A-FRONT |
| 14 | </PerpendicularityCharacteristicDefinition> | | | |
| 16 | Datum (3254) | A | Plane 4975 | 5-DATUMS |
| 17 | Datum (3263) | B | Cylinder 4963 | 5-DATUMS |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | |
| 21 | DatumReferenceFrame (3335) | A | | |
| 22 | Flatness (3243) | = .005 | GDT_35 | Plane 4975 5-DATUMS |
| 23 | Perpendicularity (3337) | ⊥ .005 A | GDT_37 | Cylinder 4963 5-DATUMS |
| 25 | Position (3305) | ⊕ 0.160 ± .002 | G | 7-CHARACTERISTICS |
| 26 | Position (3312) | ⊕ 0.010 A B (M) C (M) | G | 7-CHARACTERISTICS |
| 26 | Position (3325) | ⊕ 0.005 A B (M) C (M) | G | 6A-FRONT 7-CHARACTERISTICS |
| 27 | Position (3325) | ⊕ 0.255 ± .003 | G | |
| 27 | | ⊕ 0.010 A B (M) | | |
| 28 | Position (3332) | ⊕ 0.005 A B (M) C (M) | GDT_42 | Cylinder 4961 6C-BACK 7-CHARACTERISTICS |


```

<PerpendicularityCharacteristicDefinition id="3337">
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  <ToleranceValue>0.005</ToleranceValue>
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  <FeatureNominalIds n="1">
    <Id>4963</Id>
  </FeatureNominalIds>
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  </KeyCharacteristic>
</PerpendicularityCharacteristicNominal>
    
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  <FeatureNominalIds n="1">
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  </FeatureNominalIds>
</DatumDefinition>
    
```

Perpendicularity Tolerance

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|--------------|--|--|----------------|----------------------------|
| 6 | <PerpendicularityCharacteristicDefinition id="3337"> | | | 6A-FRONT 7-CHARACTERISTICS |
| 7 | <StatisticalCharacteristic>false</StatisticalCharacteristic> | | | 6A-FRONT 7-CHARACTERISTICS |
| 8 | <ToleranceValue>0.005</ToleranceValue> | | | 7-CHARACTERISTICS |
| 9 | <DatumReferenceFrameId>3335</DatumReferenceFrameId> | | | 7-CHARACTERISTICS |
| 10 | <MaterialCondition>NONE</MaterialCondition> | | | 7-CHARACTERISTICS |
| 11 | <ZoneShape> | | | ALL 6A-FRONT |
| 12 | <PlanarZone/> | | | ALL 6B-RIGHT |
| 13 | </ZoneShape> | | | ALL 6A-FRONT |
| 14 | </PerpendicularityCharacteristicDefinition> | | | |
| 16 | Datum (3254) | A | Plane 4975 | 5-DATUMS |
| 17 | Datum (3263) | B | Cylinder 4963 | 5-DATUMS |
| 19 | DatumReferenceFrame (3303) | A B (M) C (M) | | |
| 20 | DatumReferenceFrame (3323) | A B (M) | | |
| 21 | DatumReferenceFrame (3335) | A | | |
| 23 | Perpendicularity (3337) | $\perp .005 A$ | Cylinder 4963 | 5-DATUMS |
| 25 | Position (3305) | $\oplus \varnothing.160 \pm .002$ | | |
| 26 | Position (3312) | $\oplus \varnothing.005 A B (M) C (M)$ | | |
| 27 | Position (3325) | $\oplus \varnothing.255 \pm .003$ | | |
| 28 | Position (3332) | $\oplus \varnothing.005 A B (M) C (M)$ | | |


```

<PerpendicularityCharacteristicDefinition id="3337">
  <StatisticalCharacteristic>false</StatisticalCharacteristic>
  <ToleranceValue>0.005</ToleranceValue>
  <DatumReferenceFrameId>3335</DatumReferenceFrameId>
  <MaterialCondition>NONE</MaterialCondition>
  <ZoneShape>
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  </ZoneShape>
</PerpendicularityCharacteristicDefinition>
    
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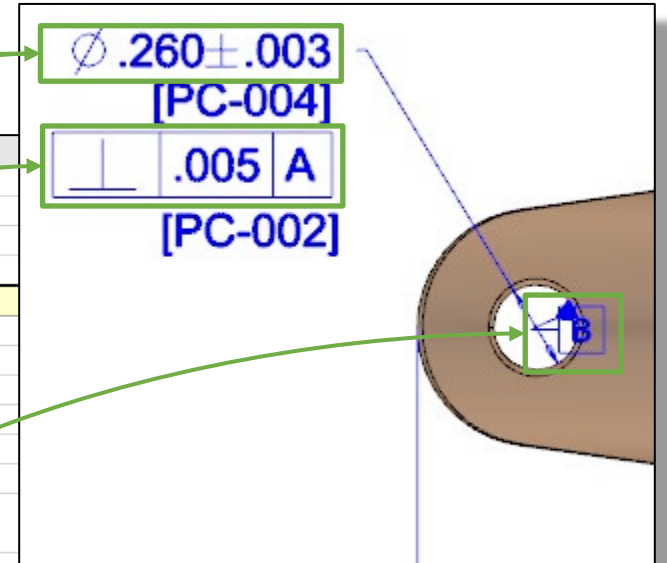
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  <FeatureNominalIds n="1">
    <Id>4963</Id>
  </FeatureNominalIds>
  <Name>GDT_37</Name>
  <KeyCharacteristic>
    <Designator>8</Designator>
  </KeyCharacteristic>
</PerpendicularityCharacteristicNominal>
    
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<DatumDefinition id="3263">
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  <DatumLabel>B</DatumLabel>
  <FeatureNominalIds n="1">
    <Id>4963</Id>
  </FeatureNominalIds>
</DatumDefinition>
    
```

Relating Dimension to Perpendicularity

| Element (id) | PMI | Name | FeatureNominal | Saved View |
|------------------------------|---|------------------|-----------------------------|--|
| Diameter (3267, 3266) | $\varnothing .260 \pm .003$ | AE_DRIVEN_DIM0 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3270, 3269) | $\varnothing .25 \pm .003$ | AE_DRIVEN_DIM1 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Diameter (3273, 3272) | $\varnothing .160 \pm .002$ | AE_DRIVEN_DIM2 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3276, 3275) | 3X $\varnothing .254 \pm .002$ | AE_DRIVEN_DIM3 | (3) Cylinder 4959 4982 4983 | 6C-BACK 7-CHARACTERISTICS |
| Diameter (3279, 3278) | 3X $\varnothing .248 \pm .002$ | AE_DRIVEN_DIM4 | (3) Cylinder 4961 5134 5135 | 6C-BACK 7-CHARACTERISTICS |
| DistanceBetween (5213, 5212) | (6.4) | REF_DIMENSION_8 | (2) CircularArc 5005 5120 | 0-OVERALL 6A-FRONT |
| DistanceBetween (5238, 5237) | (.7) | REF_DIMENSION_16 | (1) CylindricalSegment 4988 | 0-OVERALL 6B-RIGHT |
| Length (3689, 3688) | (1.5) | REF_DIMENSION_10 | (1) Plane 5231 | 0-OVERALL 6A-FRONT |
| Datum (3252) | C | | Cylinder 4967 | 5-DATUMS 6A-FRONT 6C-BACK |
| Datum (3254) | A | | Plane 4975 | 5-DATUMS 6A-FRONT 6B-RIGHT 6C-BACK 7-CHARACTERISTICS |
| Datum (3263) | B | | Cylinder 4963 | 5-DATUMS 6A-FRONT 6C-BACK |
| DatumReferenceFrame (3303) | A B (M) C (M) | | | |
| DatumReferenceFrame (3323) | A B (M) | | | |
| DatumReferenceFrame (3335) | A | | | |
| Flatness (3243) | = .005 ▽ [A] | GDT_35 | Plane 4975 | 5-DATUMS 6B-RIGHT 7-CHARACTERISTICS |
| Perpendicularity (3337) | $\varnothing .260 \pm .003$ ⊥ .005 A ▽ [B] | GDT_37 | Cylinder 4963 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3305) | $\varnothing .160 \pm .002$ ⊕ $\varnothing .010$ A B (M) C (M) | GDT_40 | Cylinder 4977 | 6C-BACK 7-CHARACTERISTICS |
| Position (3312) | $\varnothing .005$ A B (M) C (M) | GDT_41 | Cylinder 4959 | 6C-BACK 7-CHARACTERISTICS |
| Position (3325) | $\varnothing .255 \pm .003$ ⊕ $\varnothing .010$ A B (M) | GDT_38 | Cylinder 4967 | 5-DATUMS 6A-FRONT 7-CHARACTERISTICS |
| Position (3332) | $\varnothing .005$ A B (M) C (M) | GDT_42 | Cylinder 4961 | 6C-BACK 7-CHARACTERISTICS |



Relating the Dimension to the Perpendicularity Tolerance, to construct the feature control frame in cell B24, is through the FeatureNominal. Both refer to the same Cylinder.

Other Examples

- Measurements associated with PMI
- QPid associated with PMI
- Based on QIF 2.1

Measurement and QPid

| | A | B | C | D | E | F |
|----|----------------------------|--|------|----------------|---|--------------------------------------|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\Parts\DMSC\Test\WIDGET_QIF_RESULTS W QPIDS.QIF | | | 2015-10-23 14:03 | QIF 2.1.0 |
| 2 | App, Standard, Units | SOLIDWORKS 2016, CheckMate 14 for SOLIDWORKS, Origin International Inc. | | | ASME-Y14.5-1994 | MM |
| 3 | FeatureNominal Types | (5) Circle Cylinder OppositeParallelLines Plane Point | | | | |
| 4 | | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Measurement | QPid |
| 6 | Diameter (48, 47) | Ø19 ± 0.13 | | | 19.007 PASS | 2626c7bf-9e82-487a-b4d6-2cfa01e3f96a |
| 7 | Diameter (67, 66) | Ø25.4 ± 0.15 | | | 25.39 PASS | 9abb5e78-b873-44f9-bbec-09e6b7b194b7 |
| 8 | Diameter (81, 80) | Ø5 ± 0.025 | | | 4.878 FAIL 4.89 FAIL | fd1b84c3-2b35-4063-80b3-a2d2673d5271 |
| 9 | Diameter (172, 171) | Ø9.5 ± 0.15 | | | 9.454 PASS 9.46 PASS 9.47 PASS | 811229eb-2d32-481c-acd2-aace5d2e9eb3 |
| 10 | DistanceBetween (59, 58) | 5 ± 0.5 | | | 5.014 PASS | |
| 11 | DistanceBetween (193, 192) | 75 ± 0.25 | | | 74.758 PASS | |
| 12 | DistanceBetween (197, 196) | 105 ± 0.25 | | | 104.63 FAIL | 09e3b2c5-5e6f-48bc-a7ac-b0c1ac6a9f44 |
| 13 | DistanceBetween (201, 200) | 5 ± 1. | | | 4.972 PASS | d1a4b9ea-ae5c-49a1-b502-90e48b9501c0 |
| 14 | Width (209, 208) | 10 ± 0.5 | | | 9.975 PASS | 19d2ae25-a438-42af-a52f-6aa319f6dff3 |
| 29 | | | | | | |
| 30 | Angularity (161) | ∠ 0.5 H | | | 0.095 PASS | 0c910f9e-d478-4828-b423-f92116cff3b3 |
| 31 | Flatness (12) | = 0.25 | | | 0.088 PASS | 9a332d97-16dd-441d-acd8-f400b09ea800 |
| 32 | Flatness (27) | = 0.25 | | | 0.058 PASS | e74d27cd-44e0-4e55-9c17-5c1692d67d43 |
| 33 | Flatness (35) | = 0.25 | | | 0.053 PASS | 747c1f2b-3ee2-477a-bee3-a85d793e7a20 |
| 34 | Flatness (144) | = 0.25 | | | 0.057 PASS | 37deb9f2-6bbb-490f-9829-b2a0992502dd |
| 35 | Flatness (157) | = 0.5 | | | 0.094 PASS | 984b241a-5733-4fb9-bd74-25eda0510870 |
| 36 | Perpendicularity (17) | ⊥ 0.5 B | | | 0.114 PASS | b3f4a59a-d21f-4f97-9551-6cd28ae001ed |
| 37 | Perpendicularity (39) | ⊥ 0.5 B | | | 0.14 PASS | 91ebd5f0-8fbf-4fc5-9714-099e4bab3231 |
| 38 | PointProfile (98) | 2 | | | -0.274 PASS 0. PASS | 8ef7fcb4-537b-41ab-b708-60e68da6dc6e |
| 39 | PointProfile (108) | 2 | | | 0. PASS 0.051 PASS | 269fa404-1f7f-4d41-acf0-94a3ec8e2d5d |
| | PointProfile (117) | 2 | | | -0.171 PASS -0.214 PASS 0. PASS 0. PASS | 6374ef48-f658-42a8-875e-0acf5b618959 |
| 40 | | | | | 0. PASS 0. PASS 0.186 PASS 0.196 PASS | |
| 41 | PointProfile (152) | 1 B A C | | | -0.462 PASS 0. PASS | 2a760317-1bf5-4547-ab19-28b685b6d6a7 |
| 42 | Position (51) | ⊕ Ø0.5 (M) B A C | | | 0.35 PASS | 2e2ccaef-d894-497f-b56f-f83f907d7be0 |
| 43 | Position (70) | ⊕ Ø0.5 (M) J (M) | | | 0.344 PASS | 1a9722a5-f1ae-409f-b21b-8c4a78fa659f |
| 44 | Position (84) | ⊕ Ø0.25 (M) B A C | | | 0.256 FAIL 0.3 FAIL | e0e76d74-9ee9-46d7-a3f7-d5837345b245 |
| 45 | Position (175) | ⊕ Ø0.5 (M) A B C | | | 0.144 PASS 0.206 PASS 0.239 PASS | 7d69345e-0181-4601-9044-388c1d4f6b59 |
| 46 | Position (212) | ⊕ 1 (M) A C | | | 0.082 PASS | adafde91-5656-4dde-9805-319384875826 |

Column E shows Measurements associated with the Element in column A. If at least one Measurement FAILs, then the cell is colored red.

Column F shows the QPid associated with Element in column A.

Measurement and QPid

| | A | B | C | D | E | F |
|----|----------------------------|---|------|----------------|----------------------------|--|
| 1 | FileName, Date, Version | C:\Users\lipman\Documents\QIF\Parts\DMSC\Test\WIDGET_QIF_RESULTS W QPIDS.QIF 2015-10-23 14:03 QIF 2.1.0 | | | | |
| 2 | App, Standard, Units | SOLIDWORKS 2016, CheckMate 14 for SOLIDWORKS, Origin International Inc. ASME-Y14.5-1994 MM | | | | |
| 3 | FeatureNominal Types | (5) Circle Cylinder OppositeParallelLines Plane Point | | | | |
| 4 | | | | | | |
| 5 | Element (id) | PMI | Name | FeatureNominal | Measurement | QPId |
| 6 | Diameter (48, 47) | Ø19 ± 0.13 | | 19.007 | PASS | 2626c7bf-9e82-487a-b4d6-2cfa01e3f96a |
| 7 | Diameter (67, 66) | Ø25.4 ± 0.15 | | 25.489 | PASS | 9abb5e78-b873-44f9-bbec-09e6b7b194b7 |
| 8 | Diameter (81, 80) | Ø5 ± 0.025 | | 4.878 | FAIL 4.89 FAIL | fd1b84c3-2b35-4063-80b3-a2d2673d5271 |
| 9 | Diameter (172, 171) | Ø9.5 ± 0.15 | | 9.454 | PASS 9.46 PASS 9.47 PASS | 811229eb-2d32-481c-acd2-aace5d2e9eb3 |
| 10 | DistanceBetween (59, 58) | 5 ± 0.5 | | 5.014 | PASS | |
| 11 | DistanceBetween (193, 192) | 75 ± 0.25 | | 74.758 | PASS | |
| 12 | Dista | <code><DiameterCharacteristicItem id="49"></code> | | | | 09e3b2c5-5e6f-48bc-a7ac-b0c1ac6a9f44 |
| 13 | Dista | <code><Attributes n="1"></code> | | | | ASS d1a4b9ea-ae5c-49a1-b502-90e48b9501c0 |
| 14 | Widt | <code><AttributeQPId name="QPId"></code> | | | | PASS 19d2ae25-a438-42af-a52f-6aa319f6dff3 |
| 29 | | <code><Value>2626c7bf-9e82-487a-b4d6-2cfa01e3f96a</Value></code> | | | | |
| 30 | Angu | <code></AttributeQPId></code> | | | | ASS |
| 31 | Flatn | <code></Attributes></code> | | | | ASS |
| 32 | Flatn | <code><Name>10</Name></code> | | | | ASS |
| 33 | Flatn | <code><KeyCharacteristic></code> | | | | ASS |
| 34 | Flatn | <code><Designator>10</Designator></code> | | | | ASS |
| 35 | Flatn | <code></KeyCharacteristic></code> | | | | ASS |
| 36 | Perp | <code><FeatureItemIds n="1"></code> | | | | ASS |
| 37 | Perp | <code><Id>45</Id></code> | | | | ASS |
| 38 | Point | <code></FeatureItemIds></code> | | | | ASS |
| 39 | Point | <code><MeasurementDeviceIds n="1"></code> | | | | ASS 0. PASS |
| 40 | Point | <code><Id>15</Id></code> | | | | 0.051 PASS 269fa404-1f7f-4d41-acf0-94a3ec8e2d5d |
| 41 | Point | <code></MeasurementDeviceIds></code> | | | | ASS -0.214 PASS 0. PASS 0. PASS 6374ef48-f658-42a8-875e-0acf5b618959 |
| 42 | Position (51) | ⊕ Ø0.5 (M) B A C | | 0.35 | PASS | 2e2ccaef-d894-497f-b56f-f83f907d7be0 |
| 43 | Position (70) | ⊕ Ø0.5 (M) J (M) | | 0.344 | PASS | 1a9722a5-f1ae-409f-b21b-8c4a78fa659f |
| 44 | Position (84) | ⊕ Ø0.25 (M) B A C | | 0.256 | FAIL 0.3 FAIL | e0e76d74-9ee9-46d7-a3f7-d5837345b245 |
| 45 | Position (175) | ⊕ Ø0.5 (M) A B C | | 0.144 | PASS 0.206 PASS 0.239 PASS | 7d69345e-0181-4601-9044-388c1d4f6b59 |
| 46 | Position (212) | ⊕ 1 (M) A C | | 0.082 | PASS | adafde91-5656-4dde-9805-319384875826 |

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